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Four new species, and new records, of *Microchaetus* Rapp, 1849 from the Cape Province, South Africa, and Transkei (Oligochaeta: Microchaetidae)

by

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ABSTRACT

Four new species of the southern African holandric genus *Microchaetus* Rapp, 1849 are described and illustrated: *madidus*, *ritae*, *montanus* and *rivus*. Their relationships with other species are discussed, and keys are provided to distinguish the species.

New localities are recorded for *M. franciscus* Pickford, 1975 and *M. pentheri* Rosa, 1898.

New synonyms: *Microchaeta pentheri* var. *saxatilis* Rosa, 1898, *Microchaeta pentheri* var. *elizabethae* Michaelsen, 1899 and *Microchaetus saundersi* Brock & Dick, 1935 = *Microchaetus pentheri* Rosa, 1898.

INTRODUCTION

Studies on southern African megadrile Oligochaeta continue to reveal new species in the family Microchaetidae. The present paper contains the descriptions of four new species - *madidus*, *ritae*, *montanus*, and *rivus*, in the holandric genus *Microchaetus*, bringing the total number of recognised species to 27. New localities are provided for both *M. franciscus* Pickford, 1975 and *M. pentheri* Rosa, 1898. An abbreviated key to aid identification is supplied to supplement that of Plisko (1992).

MATERIAL AND METHODS

The Natal Museum's collection of microchaetids has been substantially enlarged by material collected during three field trips to the Cape Province and Transkei in 1990–1991. The material was gathered by myself, assisted by Dr B. R. Stuckenberg and Prof. A. Zicsi.

Type material of *franciscus* was loaned to me by the South African Museum. Comparative material for *pentheri* (and its synonyms) was studied in the Natural History Museum, London.

Methods of collection and preservation are similar to those described in earlier papers (Plisko 1992 1993). The terminology, conventions and definitions employed in this paper are as earlier defined (Plisko 1993).

Abbreviations:

AZ – A. Zicsi.
BMNH – The Natural History Museum, London, U.K.
BRS – B. R. Stuckenberg.

JDP – J. D. Plisko.
LEUB – Department of Ecology and Systematics of the Loránd-Eötvös University, Budapest, Hungary.
NMSA – Natal Museum, Pietermaritzburg, South Africa.
SAMC – South African Museum, Cape Town, South Africa.
USNM – United States National Museum Natural History, Washington, D.C.

TAXONOMY

Microchaetus Rapp, 1849

Type species: *Lumbricus microchaetus* Rapp, 1849.

Diagnosis: Secondary annulation present. Setae lumbricine, paired; *dd ca.* $\frac{1}{2}u$. Nephropores in or near *cd* setal lines. Dorsal pores absent. Paired female pores on 14. Male pores in clitellar region. Clitellum saddle-shaped; tubercula pubertatis present; genital fields and papillae present or absent.

Some of preclitellar septa thickened. One oesophageal gizzard in 7. Calciferous glands present. Dorsal blood vessel preclitellarly single or doubled. One pair of nephridia per segment. Holandric; testes and spermiductal funnels in 10 and 11; free or enclosed in sacs. Prostate absent.

Terrestrial. Known only from South Africa; 27 species.

Key to new species of *Microchaetus*

1	Spermathecal pores only in 12/13 and 13/14 or only in 11/12, 12/13 and 13/14 intersegmental furrows	2
–	Spermathecal pores in other positions	6
2	Spermathecal pores only in 12/13 and 13/14 intersegmental furrows	3
–	Spermathecal pores only in 11/12, 12/13 and 13/14	**madidus** sp. n.
3	Only two septa thickened, 7/8 and 8/9	**ritae** sp. n.
–	More than two septa thickened	4
4	Three septa thickened, 4/5, 7/8, 8/9	5
	Four septa thickened 4/5, 5/6, 7,8 and 9/9	**pentheri** Rosa, 1898
5	Septa 4/5 thickened moderately, 7/8, 8/9 very much thickened .	**montanus** sp. n.
–	Septa 4/5, 7/8, 8/9 thickened moderately, similar size and appearance	**rivus** sp. n.
6	Other known *Microchaetus* species, listed below, may be identified using Tables 1–2 and the key provided earlier (Plisko 1992): *benhami* Rosa, 1891; *braunsi* Michaelsen, 1899; *caementerii* Michaelsen, 1913; *crousi* Pickford, 1975; *decipiens* Michaelsen, 1899; *franciscus* Pickford, 1975; *guntheri* Pickford, 1975; *klopperi* Plisko, 1992; *ljungstroemi* Pickford, 1975; *microchaetus* Rapp, 1849; *mkuzi* Plisko, 1992; *namaensis* Michaelsen, 1908; *natalensis* (Kinberg, 1867); *papillatus* Benham, 1892; *parvus* Michaelsen, 1913; *pearsonianus* Pickford, 1975; *peringueyi* Michaelsen, 1913; *pondoanus* Michaelsen, 1913; *rosai* Michaelsen, 1908; *stuckenbergi* Plisko, 1992; *vernoni* Plisko, 1992; *zaloumisi* Plisko, 1992.	

Microchaetus madidus sp. n.

Figs 1–3

Etymology: L. Masculine *madidus* = soaked. This species was found in muddy, saturated soil of primary grassland.

Material examined: **Holotype** NMSA/Olig.00592/1, clitellate, abscised at 37 segment, Cape Province, 16 km W of Hogsback (32°35'S:26°56'E) near road to Michaell's Pass, grassland, from muddy, saturated, soil, 21 January 1990, JDP & BRS leg. **Paratypes**: NMSA/Olig.00592/2–5, 2 clitellate abscised at 25 and 150 segment; 2 juveniles, one complete, one abscised at 409; 2 cocoons with early developmental stage; all collected together with holotype. Known only from the type locality.

External characters

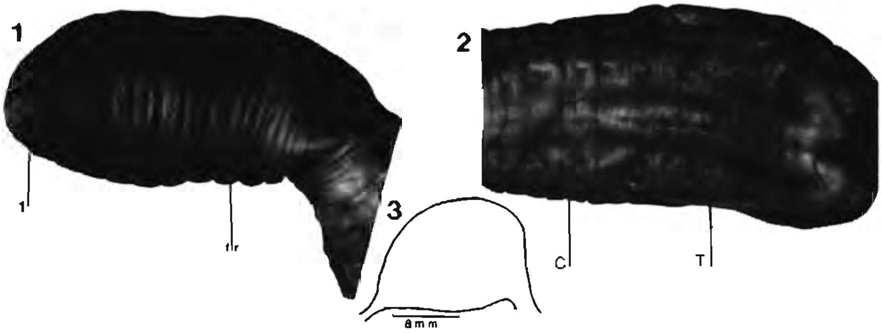
General: Body cylindrical, firm. *Colour*: In life – dorsally violet-brown with greenish tint, ventrally light grey. Alcohol preserved – dorsally dark grey with violet tint, ventrally light grey. *Dimensions*: Preserved – holotype: 54+ mm long, 7 mm wide at 10, 13 mm at tubercula pubertatis; clitellate paratypes: 54+ –156+ mm long, 8–9 mm wide at 10, 13 mm at tubercula pubertatis; juvenile complete 220 mm long, 7 mm wide at 10. *Segment number*: 381–409+; complete number unknown, as largest specimen was abscised during collection. *Prostomium*: Prolobous, medium, with 5–8 divisions. *Segmentation*: Secondary annulation present on preclitellar segments (Fig. 1); 1–2 short, simple, with longitudinal grooves; 3 with 3 incomplete, irregular annuli, anteriorly with longitudinal grooves; 4–8 with 2 ringlets similar of size and appearance, each demarcated by a few horizontal, incomplete grooves; 9 demarcated by two or three incomplete horizontal lines; following segments simple, annulated randomly. *Setae*: Closely paired, of moderate size; first pairs on 2; on annulated segments on first ringlet, on simple segments medially. *Nephridial pores*: Obvious; on anterior part of segment, very close to intersegmental furrows; first pair on 3, close to 2/3 intersegmental furrow. *Female pores*: Small, on 14, in front of *a* setae. *Male pores*: Not observed; thick, contracted muscles cover pores. *Spermathecal pores*: In 11/12, 12/13 and 13/14 intersegmental furrows.

Clitellar region: *Clitellum* (Fig. 2): Saddle-shaped, thick, clearly segmented; holotype – 11–25; paratypes – 11,12–24,25. *Tubercula pubertatis*: Large, thick, oval fields; commence above *d* setal lines, extending up to nearly *b* lines; distinctly separated from clitellum and genital fields with thick rim; on 1/*n*15,16–20,1/*n*21. *Genital fields* (Fig. 2): Large, thick, glandular plates; narrow longitudinal groove separates field into two parts; anteriorly narrower than at tubercula pubertatis; posteriorly gradually diminishing in size and thickness. *Papillae*: Small, oval, on 10–26,27, with *a* setae gradually diminishing in size.

Internal characters

Septa: Four septa thickened; 4/5 moderately; 5/6 massively (at least ten times thicker than other thickened septa), muscular; 7/8 and 8/9 moderately, similar in size and appearance to 4/5; other septa thin, although strong. *Gizzard*: In 7; large, muscular. *Calciferous glands*: In 9; large, lateral appendages clearly distinguished dorsally and ventrally. *Intestine*: Commences in 13. *Typhlosole*: Commences in 13, terminates in area of 281–303; large tube. *Dorsal blood vessel*: Single in 4–5; doubled, not separated in 6–7; 8 separated; in 9 cordiform; single when crossing septa, in 10 and following segments. *Paired dorso-ventral vessels*: 5–8 thin tubes; 9–11 enlarging gradually, moniliform. *Nephridia*: Meganephridia; large coiled loops with large oblong caeca.

Reproductive organs: *Spermiductal funnels*: Paired, large; in 10 and 11 respectively. Vasa deferentia seen only in segment 12, where thick glandular tissue covers their posterior parts. *Seminal vesicles*: In 10 and 11, projecting into 11 and 12 respectively. *Spermathecae*: 1 or 2 pairs of long, coiled ampullae per segment, close to septa 11/12, 12/13, 13/14; usually one pair in anterior segment, in two following segments two pairs, with ampullae very close together. *Ovaries*: Not seen; thick layer of glandular tissue in 10–25 apparently obscures them. *Genital glands*: In 10–27; paired, small, oblong tubes, with one seta per gland.



Figs 1–3. *Microchaetus madidus* sp. n. 1. Anterior part with prostomium, simple segments 1–2, annulated segment 3, the subsequent segments with two ringlets: number 1 refers to first segment; fr = first ringlet of seventh segment. 2. Clitellar region ventrally: C = clitellum; T = tuberculum pubertatis. 3. Cocoon.

Biological notes: Specimens were found in an expanse of muddy soil in a shallow valley, saturated with naturally accumulated rainwater, in montane primary grassland. The higher part of this valley was dry. Freshly made casts were noticeable only on the surface of wet, muddy, soft soil. The casts were in the shape of short, flat, elliptical rings with an oval hole in the middle. It appears that excreted soil was so much diluted that, on being deposited on the surface, it was easily dispersed, leaving a marginal rim shaped by the caudal part of the body. When fresh casts were moved, the posterior end of the earthworm was seen, despite it being a sunny and hot day.

Cocoons (Fig. 3) are large, 16 mm long, yellowish-grey. Occurrence of sperm in spermiductal funnels, and cocoons found in muddy soil in January, suggests that the species is sexually active during the rainy season.

Discussion: One of a group of species with spermathecal pores in three intersegmental furrows, having anterior septa very much thickened, and being large, with strong musculature. A close similarity can be detected with *M. decipiens* Michaelsen, 1899. Both species have spermathecae in three segments, clitellum occupying fourteen segments, and four septa thickened. However, the position of the first row of spermathecal pores in 11/12 (in the furrow of segment consisting posterior pair of testes and spermiductal funnels) suggests a possible relationship with *M. caementerii* Michaelsen, 1913, characterised by a similar condition. However, *caementerii* is known only from a very restricted area of Natal.

Microchaetus ritae sp. n.

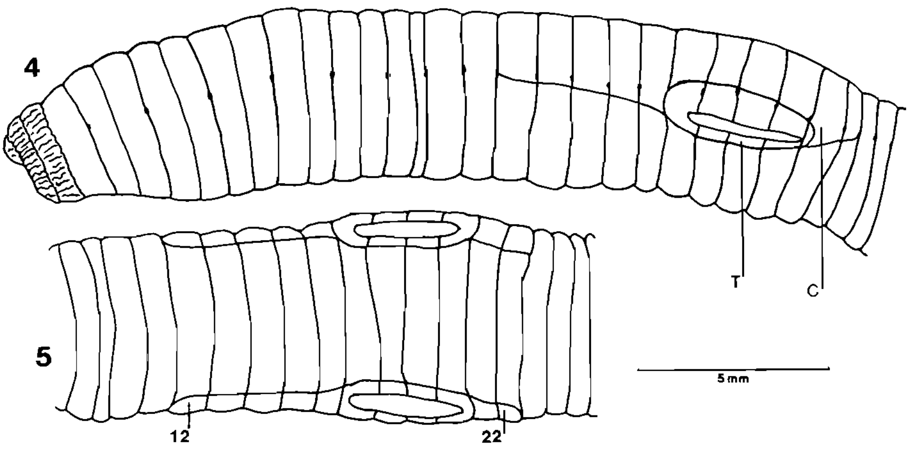
Figs 4–5

Etymology: Named in honour of Mrs Rita van Vuuren of Adelaide, whose assistance in the collection of microchaetids in the Cape Province resulted in the discovery of this species.

Material examined: **Holotype** NMSA/Olig.0 0598/1, clitellate, Cape Province, 8 km NE of Adelaide (32°41'S:26°20'E) Stanford Park, farm of Mr. E. P. Klopper, on bank of local stream, from damp soil, 23 January 1990, JDP & BRS. **Paratypes**: NMSA/Olig. 00598/2–3, 2 clitellate, collected together with holotype. Known only from the type locality.

External characters

General: Body cylindrical, firm. *Colour*: Alcohol preserved, yellowish-white. *Dimensions*: Preserved and slightly contracted – holotype 125 mm long, 4 mm wide at 10, 6 mm at tubercula pubertatis; paratypes: 68+ –104 mm long, 4 mm wide at 10, 6 mm at tubercula pubertatis. *Segment number*: Holotype, 238; paratypes, 107+ –197. *Prostomium*: Prolobous, medium. *Segmentation*: Secondary annulation present on preclitellar segments (Fig. 4); 1 and 2 simple, with longitudinal grooves; 3 simple; 4–8 with 2 simple ringlets, similar size and appearance; 9 with two ringlets, first longer than second; 10 and the following simple or randomly annulated with incomplete transverse grooves. *Setae*: Minute, closely paired; first pairs on 3. *Nephridial pores*: in *cd* setal lines; first in 3/4. *Female pores*: Not observed; probably



Figs 4–5. *Microchaetus ritae* sp. n. 4. Anterior part laterally: C = clitellum; T = tuberculum pubertatis. 5. Clitellar region ventrally: numbers refer to segments.

covered by contracted tissue of 14. *Male pores*: In 18/19 intersegmental furrow, on posterior part of tubercula pubertatis. *Spermathecal pores*: In 12/13 and 13/14.

Clitellar region: *Clitellum* (Fig. 5): Yellowish-white, saddle shaped, on 11,12–22, segmented; anteriorly not clearly bordered. *Tubercula pubertatis*: Oval ridges, distinctive on 17–20,1/*n*21; between *bc* setal lines, terminating with clear edges. *Papillae*: On holotype and one paratype – no papillae; on other paratype – very small swellings, in *ab* setal lines, on 17–19.

Internal characters

Septa: Only two septa, 7/8, 8/9, thickened moderately; 4/5, 5/6, 6/7 not thickened. *Gizzard*: In 7, muscular, large. *Calciferous glands*: In 9; a pair of hemispherical, lateral appendages, clearly separated ventrally and dorsally. *Intestine*: Commences in 13. *Typhlosole*: Commences in 13, terminates in area of 127–132; one paratype, with regenerated segments has typhlosole extended until its last segment; large tube, anteriorly with deep medial convex, gradually terminating. *Dorsal blood vessel*: Doubled, not separated, in 7; in 8 doubled, separated; 9 cordiform; crossing septa, in 10 and in following segments single. *Paired dorso-ventral vessels*: In 5–8 thin, gradually enlarging tubes; large, moniliform in 9–11. *Nephridia*: Meganephridia; coiled loops, with oblong caeca.

Reproductive organs: *Spermiductal funnels*: In 10 and 11; a pair per segment, large, closely connected to vesiculae seminales. Vasa deferentia run separately up to segment 18, where they enter into body wall and to male pores in 18/19 intersegmental furrow. *Seminal vesicles*: 2 pairs of large sacs, commencing in 10 and 11, and projecting into 11 and 12 respectively. *Spermathecae*: Two pairs per segment, oblong, curved ampullae; close to septa 12/13 and 13/14 in *cd* setal lines. *Ovaries*: Not found; probably embedded in wall tissue of 13. *Genital glands*: Variable in number, size and shape; small, flat, or oblong finger-shaped 'prostate-like' glands; in 9, 11, 13, 14, 15, 18; in holotype not paired; in dissected paratype: left side – in 17 with two divisions, in 18 with three, in 19 with only one finger-shaped gland; right side – in 9, 11, 13, 14, 15, small short with two divisions, in 18 one very large, composed from five oblong, finger-shaped divisions.

Biological notes: Specimens were found in wet soil in the bed of a small, dried-out stream, in indigenous bush, close to primary montane grassland. It is not known if the species occurs in neighbouring grassland or inhabits the bank of the stream. Iridescence, found in spermiductal funnels, suggests sexual activity in summer, during the rainy season.

Discussion: Resembles *pentheri* in the position of spermathecae, clitellum and tubercula pubertatis. Differs in thickness of septa, the position of male pores located in 18/19 intersegmental furrow and shape of typhlosole.

Microchaetus montanus sp. n.

Figs 6–7

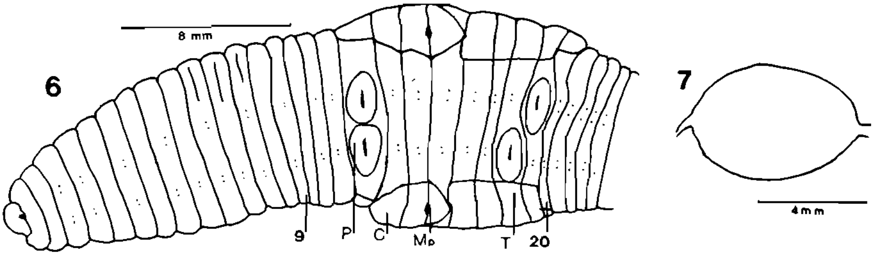
Etymology: L. masculine *montanus* = montane. Type locality is in a mountainous region.

Material examined: **Holotype** NMSA/Olig.00616/1, Cape Province, 6 km E of

Barkly Pass (31°14'S:27°49'E) *ca.* 2000 m asl, on the side of Road 53 leading to Rhodes, primary grassland, dry soil, between roots of various plants, 25 January 1990, JDP & BRS leg. **Paratypes** collected together with holotype: NMSA/Olig.00616/2–5, 2 clitellate, 2 juveniles, and NMSA/Olig.00615, 1 clitellate, 5 juveniles, 2 cocoons with individuals in embryonic stage, 1 juvenile removed from dissected cocoon. Known only from the type locality.

External characters

General: Body cylindrical, firm. *Colour*: In life – pinkish-grey. Alcohol preserved – yellowish-white, not pigmented. *Dimensions*: Preserved and slightly contracted – holotype 110 mm long, 8 mm wide at 10, 10 mm at tubercula pubertatis; paratypes – clitellate, 92–120 mm long, 7–8 mm wide at 10, 9–10 mm at tubercula pubertatis; juveniles 21–41 mm long, 1–3 mm wide; individual removed from dissected cocoon *ca.* 26 mm long, 2 mm wide. *Segment number*: Holotype, 112; clitellate paratypes, 116–149; juveniles, 120–154. *Prostomium*: Prolobous, very small. *Segmentation*: Secondary annulation present on preclitellar segments; 1 and 2 simple with longitudinal grooves; 3 simple; 4–9 with 2 ringlets, similar appearance, however, first ringlet longer than second; 10 and the following simple or randomly annulated with incomplete transverse furrows. *Setae*: Medium, conspicuous; paired; *aa* > *bc*; *ab* > *cd*; *dd ca.* $\frac{1}{2}u$; first pairs on 2; on annulated segments on first ringlet. *Nephridial pores*: In *cd* setal lines; first pair in 3/4. *Female pores*: Not observed; probably covered by contracted tissue of 14. *Male pores*: In 14/15, with large glands on 14 and 15, at anterior part of tubercula pubertatis. *Spermathecal pores*: In 12/13 and 13/14.



Figs 6–7. *Microchaetus montanus* sp. n. 6. Anterior part with clitellar region ventrally: C = clitellum; P = papilla; T = tuberculum pubertatis; Mp = Male pore; numbers refer to segments. 7. Cocoon.

Clitellar region (Fig. 6): *Clitellum*: Yellowish-white, saddle shaped, extending below *cd* setal lines; on 12–20, segmented; clearly bordering anteriorly at margin of 11/12, posteriorly at 20/21 less distinctly. *Tubercula pubertatis*: Rectangular, swollen ridges, distinctive on 16–18, expanding clearly on 19; dorsally commence slightly below *cd* setal lines, ventrally extending to half of space between *bc* setal lines, terminating with clear edges; segments 13–19, between ventral edges of tubercula pubertatis and *b* setal lines, wrinkled with small depression. *Papillae*: Small, horizontal, oblong swellings, with tiny depressions in their middle; usually a pair per segment, in *ab* setal lines, on 12 and 19; occasionally single on 18 and 19.

Internal characters

Septa: 4/5 moderately thickened, elastic, strong; 7/8 and 8/9 much thickened, muscular; 5/6 6/7 and others thin, strong. *Gizzard*: In 7, anteriorly muscular, posteriorly softened. *Calciferous glands*: In 9; a pair of hemispherical, lateral appendages, clearly separated ventrally and dorsally. *Intestine*: Commences as enlarged, simple tube in 12, changing into an irregular folded condition in 13; externally, dorsally, on 19–25,26 seven or eight pairs elongated, triangular appendages, irregular in size, of unknown function. *Typhlosole*: Commences in 15, terminates in area of 67; large, simple tube, terminating gradually. *Dorsal blood vessel*: Partly doubled, not separated in 5–7; in 8 doubled, separated; 9 cordiform; crossing septa, in 10 and subsequent segments single. *Paired dorso-ventral vessels*: Thin, gradually enlarging tubes in 5–8; moniliform in 9–11. *Nephridia*: Meganephridia; large caeca with coiled loops.

Reproductive organs: *Spermiductal funnels*: In 10 and 11; a pair per segment, large, enclosed in testis sacs, closely connected to vesiculae seminales. *Seminal vesicles*: 2 pairs of large sacs, commencing in 10 and 11, and projecting into 11 and 12 respectively. *Spermathecae*: One or two pairs per segment, small, oblong ampullae; close to septa 12/13 and 13/14, between *bc* setal lines; in 12 below genital glands. *Ovaries*: Not observed; probably embedded in thick wall tissue of 13. *Genital glands*: One pair per segment, flat, round, with one seta; in 12 and 19, corresponding with papillae.

Biological notes: This species was found in the southern part of the Drakensberg range, at *ca.* 2000 m asl. The locality was above a small, natural water reservoir, in the bank of a ditch. Close to this site a large area of primary grassland had been converted into agricultural land.

Mature individuals, juveniles and cocoons of *montanus* were found together. The presence of cocoons in dry soil, between the roots of various indigenous plants (not closely adjacent to the water reservoir) indicates that *montanus* is indigenous to its montane habitat. Of note was the discoverey of 37 juvenile or semimature specimens of an evidently introduced lumbricid species (probably *Allolobophora caliginosa* (Savigny, 1826)) which were found adjacent to the reservoir *ca.* 100 m from the *montanus* type locality, in wet, saturated soil.

Iridescence, found in spermiductal funnels of clitellate specimens, and the cocoons collected at the end of January, indicate sexual activity in summer, during the rainy season. This part of the country receives *ca.* 70% of its average annual precipitation (1420 mm) between November and March (Tyson *et al.* 1976). Besides rainfall, an occasional snowfall and fog occurs in any month of the year and contributes to soil moisture.

Cocoons (Fig. 7) are yellow-brown, 6–7 mm long, 5–6 mm wide. A dissected cocoon contained only one, large, well-developed specimen, with *ca.* 130 segments.

Discussion: The relationships of this species are difficult to establish. The position of spermathecae and their pores in 12/13, 13/14 intersegmental furrows places it in a group comprising *pentheri, rivus* and *ritae.* It differs, however, in general appearance, low number of segments, position of clitellum and tubercula pubertatis.

M. montanus is the only species of *Microchaetus* recorded from the Drakenberg mountain range. The only other Microchaetidae recorded from this area belong to *Proandricus* (*P. gracillis* (Michaelsen, 1907), *P. lesothoensis* (Reinecke & Ryke, 1969), *P. pajori* Plisko, 1993). All four species were found at altitudes between 1820–3200 m asl.

Microchaetus rivus sp. n.

Fig. 8

Etymology: L. *rivus* = stream. This species was found in wet soil adjacent to a stream.

Material examined: **Holotype** NMSA/Olig.00501, clitellate, Transkei, 26 km N of Umtata (31°35'S:28°48'E) east side of National Road N2, grassland, in bank of local stream, from wet soil, 17 January 1990, JDP & BRS leg. **Paratypes**: NMSA/Olig.00502, 8 clitellate and 3 juveniles, collected together with holotype. Known only from the type locality.

External characters

General: Body cylindrical, firm. *Colour*: In life – dorsally dark violet, ventrally yellowish-grey. Alcohol preserved – dorsally violet, darker up to 38, diminishing gradually through following 20 segments into thin dark strip; ventrally light grey. *Dimensions*: Preserved and stretched into slightly unnatural dimension by incorrect preservation – holotype 92 mm long, 3 mm wide at 10, 3,5 mm at tubercula pubertatis; paratypes: 22+ (abscised behind clitellum) – 80 mm long, 3 mm wide at 10, 4 mm wide at tubercula pubertatis. *Segment number*: Holotype 249, paratypes 218–303. *Prostomium*: Prolobous, small. *Segmentation*: Secondary annulation present on preclitellar segments; 1 and 2 simple, with longitudinal grooves; 3 simple; 4–8 with 2 simple ringlets of similar size and appearance; 9 with 2 ringlets, second shorter than first; 10 and the following simple, gradually diminishing in size. *Setae*: Medium in size; paired; *aa* > *bc*; *ab* = 1,5 *cd*; *dd ca.* $\frac{1}{2}u$; first pairs on 3, on annulated segments on first ringlet; on simple segments medially. *Nephridial pores*: Small, first

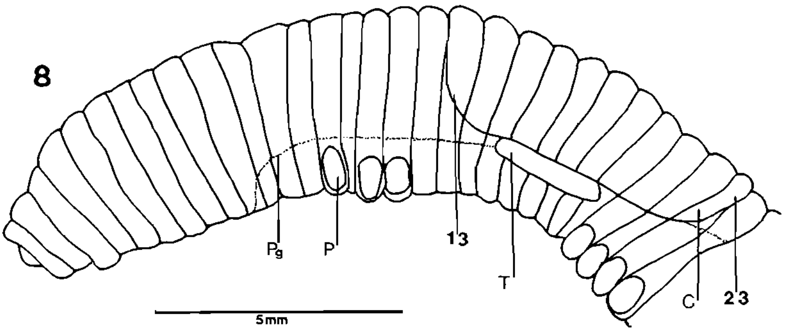


Fig. 8. *Microchaetus rivus* sp. n.: C = clitellum; P = papilla; T = tuberculum pubertatis; Pg = pigment's line; numbers refer to segments.

pair in 3/4. *Female pores*: very small, on anterior part of 14, between *ab* setal lines. *Male pores*: Minute, with modest swellings; in 14/15. *Spermathecal pores*: In 12/13 and 13/14 intersegmental furrows.

Clitellar region (Fig. 8): *Clitellum*: Not fully developed on type material; anteriorly and posteriorly with no clear boundary; laterally extends slightly below *cd*, ending abruptly; segmented; holotype, 13–23; paratypes, 12,13–22,23. *Tubercula pubertatis*: Oblong, narrow swellings, on 16–19,20, extending anteriorly on 15. *Papillae*: Modest glands in *ab* setal lines; on 9 10 11 and 20 21 22 23.

Internal characters

Septa: 4/5, 7/8 and 8/9 thickened moderately, similar size and appearance. *Gizzard*: In 7, medium size. *Calciferous glands*: Lateral appendages, separated dorsally and ventrally. *Intestine*: Commences in 13. *Typhlosole*: Commences in 17, 17/18 or 18; terminates in area of 133. *Dorsal blood vessel*: 5 single, 6–7 doubled, close; 8 doubled, separated; 9 cordiform; crossing septa, in 10 and following, single. *Paired dorso-ventral vessels*: 5–8 thin tubes, 9–11 enlarging gradually. *Nephridia*: Meganephridia; coiled loops with oblong caeca.

Reproductive organs: *Spermiductal funnels*: Large, free funnels; in 10 and 11 respectively. *Seminal vesicles*: Large, paired sacs, in 11 and 12. *Spermathecae*: A pair per segment, close to 12/13 and 13/14 septa; oblong, claviform, firm ampullae. *Ovaries*: Not observed; probably in thick tissue of 13. *Genital glands*: Two groups of short, firm glands, with *ab* setae; anterior group in 9 10 11 laterally bearing supportive thin, strong muscles; posterior in 20 21 22 23; all correspond with external papillae.

Biological notes: Found in the bank of a partly dry local stream, in moist soil. Specimens were active and vigorous when collected, but very quickly decomposed when kept in a small soil sample. The surrounding grassland was eroded, with a thin layer of poor soil. It is difficult to decide whether the species occurs naturally in this site or was transported by stream-water from neighbouring grassland-pasture areas.

Discussion: The relationships of this species are difficult to establish. Distinctive, but somewhat similar to *ritae*; both have two pairs of spermathecal pores in 12/13 and 13/14. Differs in position of clitellum, tubercula pubertatis, dimensions and shape of typhlosole.

Microchaetus franciscus Pickford, 1975

Microchaetus franciscus Pickford, 1975: 46; Reynolds & Cook, 1976: 103; Plisko, 1992: 339. Holotype USNM 53100-4 (not seen).

Material examined: Cape Province: **Paratypes**: SAMC 21542, 2 anterior parts of semimature specimens, Swellendam [34°02'S:20°26'E] Distr., Duivels Bosch in the Langebergen near Swellendam, 12 December 1926, G. E. H[utchinson] & F. W. P[aish]. Other material: NMSA/Olig.01174, 1 clitellate abscised at 493 segment, 2 semimature abscised posteriorly, 14 various parts of individuals, abscised or autotomised, 20 km W of Swellendam, from hard, dry soil near small water reservoir, 29 November 1991, JDP & AZ leg.

Known only from the type locality and its neighbourhood. My new material was compared to paratype specimens, kindly loaned to me by SAMC. External and internal characters in both samples are in accord with Pickford's (1975) description. However, some differences were observed and for this reason a description of new material is provided.

External characters

General: In life, and preserved – body cylindrical and firm; anterior part very hard, due to large gizzard, and massive, thick septa. *Colour*: In life – dorsally pinkish grey with greenish tint, ventrally light grey. Alcohol preserved paratype material brownish-pink; other material dark grey.

Dimensions: Preserved and contracted – 280+ mm long, 8 mm wide at 10, 12 mm at tubercula pubertatis. *Segment number*: 489–493+. *Prostomium*: Prolobous, large, with eight divisions, each with longitudinal grooves. *Segmentation*: Secondary annulation present on preclitellar segments. 1–2 simple with longitudinal grooves; 3 with 2 ringlets, each with longitudinal grooves; 4–7 with 2 ringlets similar size and appearance, each demarcated by one horizontal, incomplete groove; 8–9 with 2 ringlets, each demarcated by three not completed horizontal lines; the following simple. *Setae*: Very closely paired; minute on 3–9; since 10 slightly increasing in size. *Nephridial pores*: Obvious; first pair in 2/3 intersegmental furrow. *Female pores*: On 14, small. *Male pores*: in 18/19 intersegmental furrow. *Spermathecal pores*: In 13/14, 14/15 and 15/16 intersegmental furrows.

Clitellar region: *Clitellum*: Saddle-shaped; on fully mature specimens, from my new material, on 12–28; on semimature paratype 1/*n*13–26. *Tubercula pubertatis*: New material – 16–21; paratypes, tubercula less developed, on 17–20,21. *Papillae*: Small swellings in *ab* setal lines on 10–26.

Internal characters

Septa: Four septa thickened; 4/5, 5/6, 6/7 extremely thickened, massive, equal in size, muscular; 7/8 thickened, although, much thinner than 6/7. Pickford (1975) noted that only septa 4/5, 5/6, 6/7 are thickened. I have examined paratypes and found septum 7/8 thickened, muscular and strong, although softened and decomposed. In freshly preserved material, the thickness is more prominent. *Gizzard*: In 7; oblong, much broader at its anterior part in area of 6/7, with septa 6/7 and 7/8 closely attached to its external, muscular tissue. *Calciferous glands*: In 10–11; Pickford (1975) recorded it only in 11; in paratype and in my new material they are in 10–11; large lateral appendages, separated dorsally and ventrally. *Intestine*: Commences in 14. *Typhlosole*: Large, simple; commences in 14, terminates in area of 269–285. *Dorsal blood vessel*: Single in 5–8; in 9 very large cordiform organ, composed from two large hemispherical tubes; single in 10 and the following segments. *Nephridia*: Meganephridia; in accord with Pickford's description.

Reproductive organs: *Spermiductal funnels*: One pair of large, free funnels per segment; in 10 and 11 respectively. *Seminal vesicles*: Large sacs in 11 and 12. *Spermathecae*: 2 or 3 ampullae per segment, close to septa 13/14, 14/15, 15/16. In paratype material not available to me for examination, Pickford (1975) recorded number of spermathecae more variable, finding 1–5 per segment, and additional one spermatheca in 16/17. *Ovaries*: Not observed. *Genital glands*: Varying in size and appearance; usually a pair of two, medium size, oblong glands per segment, in 9–32.

Biological notes: New material was found in very dry, hard, clayey soil, on the bank of a small, man-made water reservoir. Hard casts were present throughout the area of primary grassland surrounding the locality. Most of the specimens were in aestivation (closely coiled up in balls) and found close to the water reservoir.

Microchaetus pentheri Rosa, 1898

Microchaeta pentheri Rosa, 1898: 1.
Microchaetus pentheri: Michaelsen, 1900: 452; Brock & Dick, 1935: 239; Brinkhurst & Jamieson, 1971: 58, 739; Pickford, 1975: 23; Reynolds & Cook, 1976: 154; Plisko, 1992: 340.
Microchaetus pentheri f. *typica*: Michaelsen, 1918: 323.
Microchaeta pentheri var. *elizabethae* Michaelsen, 1899: 115.
Microchaetus pentheri var. *elizabethae*: Michaelsen, 1900: 453; 1918: 323; Reynolds & Cook, 1976: 98.
Microchaeta pentheri var. *saxatilis* Rosa, 1898: 3.
Microchaetus pentheri var. *saxatilis*: Michaelsen, 1900: 453; 1918: 323.
Microchaetus saxatilis: Brock & Dick, 1935: 237. **Syn. n.**
Microchaetus saundersi Brock & Dick, 1935: 238. **Syn. n.**

Type depositaries of *M. pentheri*, *M. pentheri* var. *saxatilis*, and *M. pentheri* var. *elizabethae* unknown (Reynolds & Cook 1976 1981 1989). *M. saundersi* deposited in BMNH, 1934.10.11.9-12.

M. pentheri was described on one poorly preserved specimen collected in the area of Grahamstown (33°20'S:26°31'E). In the same paper Rosa (1898) described *M. pentheri* var. *saxatilis*, also on a single specimen found in close proximity to the type of *pentheri*. General appearance, thickness of septa, holandric character, and position of spermathecae found in both specimens suggests conspecificity with *pentheri*; however, body dimensions, position of clitellum, characters of papillae and genital glands, were slightly different and were used for the separation of 'varieties'. Another specimen, again showing a deviation in the position of tubercula pubertatis, papillae and genital glands, was described by Michaelsen (1899) as *M. pentheri* var. *elizabethae*. Brock & Dick (1935), using material from Grahamstown (supposedly from the type locality of *pentheri s.s.*), identified three species: *pentheri*, *saxatilis* and a new species *M. saundersi*. Identifications were based on the position of papillae and the formation of the genital glands. However, data produced by these authors do not justify the separation of these species. A specimen of *M. saundersi*, deposited in BMNH, bearing species name and collection data 'Grahamstown, South Africa, 1934.10.11.9/12, type; Ref. Rec. Albany Mus. Grahamstown, 4, 1935, pp.236/242' is evidently the type of *saundersi*, although, the authors indicated that the type specimens were to be deposited in the Albany Museum, Grahamstown. I examined this specimen, and found external and internal characters in accord with Brock & Dick's (1935) description, however, did not record sufficient evidence to distinguish it from *M. pentheri* Rosa, 1898. Six clitellate specimens, collected in Grahamstown, labelled '*M. saxatilis*, Rosa', also deposited in BMNH (1934:10:11:5-8), were examined by Brinkhurst and Jamieson and were used for anatomical study of *Microchaetus*. The results were published in Brinkhurst & Jamieson (1971) under '*pentheri* (= *saxatilis*)'.

The characters used to distinguish *pentheri*, *saxatilis* and *elizabethae* are present in individuals collected recently in the Grahamstown area, Hogsback and Stanford Park (Adelaide District). Comparing data given by Rosa (1898), Michaelsen (1899 1900 1918), and Brock & Dick (1935), with this new material, it is evident that papillae and genital glands are highly variable. Variability of these characters is known in other species of microchaetids, and supposedly reflects different stages of maturity. It is possible that a comparative study of calciferous glands, suggested by Michaelsen (1918), might throw some light on the limits of specific variation. At present it is not possible to draw conclusions on this topic, because data given by Michaelsen (1918) were based only on *elizabethae* with no comparable examination of *pentheri* and *saxatilis*. For this reason the nature of the calciferous glands cannot be used to distinguish these three 'varieties'.

An examination of Rosa's and Michaelsen's types could help to confirm the synonymy, but the locations of the types of *M. pentheri s.s.*, var. *elizabethae*, and also var. *saxatilis*, are unknown. Reynolds & Cook (1976) could not locate the types, stating '*typus ammissus*'. The evidence now available clearly shows that these infraspecific taxa do not warrant recognition.

New material examined: Cape Province: NMSA/Olig.00571, Hogsback (32°35'S:26°56'E), Auckland Forest, higher part of mixed forest, above path, from moist soil, 21 January 1990, 1 clitellate, JDP & BRS leg.; NMSA/Olig.00594, 18 km NE of Adelaide (32°41'S:26°20'E), Mr E. P. Klopper Farm, Stanford Park *ca.* 1100 m asl, montane grassland, from dry soil near small water reservoir, 6 semimature and 7 juveniles, majority of specimens being in aestivation, JDP & BRS leg.; NMSA/Olig.01129, 61 km N of Grahamstown (33°20'S:26°31'E), at *ca.* 250 m asl, on bank of ditch, from dry, rocky soil, 21 November 1991, 4 clitellate complete, 4 abscised, JDP & AZ leg.; NMSA/Olig.01138 and NMSA/Olig.01139, Grahamstown, indigenous bush, very dry soil, 22 November 1991, 1 clitellate abscised at 271, 2 juveniles complete, 1 abscised posterior part, JDP & AZ leg. The species is known from many localities in the Eastern Cape Province.

External characters

General: Body cylindrical, firm. *Colour*: In life – dorsally dark-grey with greenish tint, or violet-grey; ventrally grey. Alcohol preserved: dorsally dark grey, or violet grey (from Adelaide), ventrally yellowish-grey. *Dimensions*: Preserved: 92+ –365 mm long, 9 mm wide at 10, 11 mm at tubercula pubertatis. *Segment number*: 144+ –376. *Prostomium*: Prolobous, short. *Segmentation*: Secondary annulation present on preclitellar segments. 1–2 short, simple with longitudinal grooves; 3 with 3 incomplete, irregular transverse furrows; anterior part with irregular longitudinal grooves; 4–8 with 2 ringlets similar size and appearance, each with one or two transverse, complete or incomplete furrows; 9 with 2 annuli, first longer than second; 10 and the following simple, or randomly with transverse lines. *Setae*: Closely paired, of medium size; first pairs on 2; on annulated segments on first ringlet. *Nephridial pores*: Conspicuous; first pair in 3/4 intersegmental furrow. *Female pores*: On 14, in front of *d* setae. *Male pores*: In 17/18 intersegmental furrow, large, separating tubercula pubertatis into two parts; (Rosa (1898) and Michaelsen (1900 1918) speculated on the position of male pores and suggested that they are on segment 15; Brock & Dick (1935) found vasa deferentia going into 17/18; my observation confirmed male pores in 17/18). *Spermathecal pores*: In 12/13 and 13/14 intersegmental furrows.

Clitellar region: *Clitellum*: Saddle-shaped, clearly segmented; on 11,12–22,1/*n*23,23. *Tubercula pubertatis*: on 15,16,17–20; rectangular fields, separated at 17/18 intersegmental furrow into two divisions; commence below *d* setal lines, extending almost to *b* lines; separated from clitellum with thin rim. *Papillae*: Variable in size and position; small or large, oval, oblong or circular; on 10, or 10–15, or 9–13 and 18–19; some papillae correspond with genital glands, others do not.

Internal characters

Septa: Four septa thickened; 4/5 moderately; 5/6 excessively, at least 5–8 times thicker than 4/5, muscular; 7/8 and 8/9 modestly, less than 4/5; other septa thin, though, strong. *Gizzard*: In 7; large, muscular. *Calciferous glands*: Egg-shaped lateral appendages, clearly distinguished dorsally and ventrally; in 9. *Intestine*: Commences in 13. *Typhlosole*: commences immediately with intestine, in 13; anteriorly large, tube-shaped, posteriorly ribbon-shaped, terminating gradually in area of 189–207; in one specimen with 374 segments extends to 260. *Dorsal blood vessel*: Doubled, not separated in 6–7; in 8 doubled, separated; in 9 cordiform; single in 5, crossing septa, in 10 and following. *Paired dorso-ventral vessels*: 5–8 thin tubes; 9–11 enlarging gradually, moniliform. *Nephridia*: Meganephridia; large coiled loops with large oblong caeca.

Reproductive organs: *Spermiductal funnels*: Two pairs of large funnels; in 10 and 11; vasa deferentia start in 10 and 11, continue apart up to 12, then become closer to one another in 15, unifying into single ducts which in 17 enter body wall and proceed to male pores in 17/18 intersegmental furrow. *Seminal vesicles*: Two pairs of large sacs; in 10 and 11. *Spermathecae*: 2 or 3 pairs per segment; long, bent, coiled, or spiral tubes, always close to one another; near septa 12/13, 13/14; *Ovaries*: Not observed. *Genital glands*: Variable in size, shape and position; corresponding or not with papillae; in 9 10 18; 10 17 18; 10 16 17; 10–18 and 28–32; flat, composed of 3–5 divisions; or large, oblong 2–6 finger-shaped tubes, projecting into neighbouring segments; always unified basally.

Biological notes: Individuals of this species were found in different biotopes: in dry grassland soil; indigenous bush; forest with mixed indigenous and introduced trees; under thin layers of litter; on banks of small water reservoirs in dry soil; and in ditches near roads. All specimens, with exception of one from indigenous montane grassland, are similar in size and appearance; individuals from the Adelaide area are larger and dorsally much darker.

Discussion: *M. pentheri* and its two 'varieties' were described on single specimens, distinguished on differences in shape and conformation of genital glands. Although many specimens of *saundersi* were examined by Brock & Dick (1935), only papillae and genital gland characteristics were used to distinguish *saundersi* from *pentheri*.

In the newly studied material, papillae and genital glands were the most variable and conflicting characters. The number and location of papillae can be associated with genital glands, or can occur without correlation. Papillae and genital glands are highly variable in number, shape and position. Present knowledge of their anatomical and histological structure is of minor taxonomic value. Future examination of the relationship between papillae and genital glands throughout the maturation of individuals may throw more light on this matter.

DISCUSSION

Of the 27 species of *Microchaetus*, 15 have been described from the Cape Province. *M. benhami* Rosa, 1891, described from an unknown locality, was, however, recorded by Michaelsen (1913*a*) and Pickford (1975) from the neighbourhood of Cape Town. The four additional species described in this paper increase the number known from the Cape Province to 20. The remaining seven species (Tables 1–2) are known only from Natal. Different positions of spermathecal pores in all the known species of this genus are evident (Tables 1–2 - including species with no spermathecae). Using the positions of spermatical pores, 14 groups can be distinguished (Table 1). Grouping species according to the number of intersegmental furrows occupied by spermathecae (while ignoring their position) establishes 7 groups (Table 2). Considering the position of the first intersegmental furrow occupied by spermathecal pores, the species can be grouped as follows:

A. Species with no spermathecae (1 species).
B. Species with spermathecal pores commencing in 9/10 or 10/11 or 11/12 intersegmental furrow, eg. in furrows of segments occupied by both pairs of testes and spermiductal funnels (2 species), or by last pair of testes and spermiductal funnels (2 species).
C. Species with spermathecal pores commencing in 12/13 (14 species).
D. Species with spermathecal pores commencing in 13/14 (8 species).

TABLE 1

Microchaetus species arranged in accordance with the position of spermathecal pores (species are from the Cape Province unless marked with an asterisk as being from Natal).

Intersegmental furrows									Species
9/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17		
–	–	–	–	–	–	–	–	=	*namaensis*
(+)	+	+	+	+	+	+	–	=	*mkuzi**
–	+	+	+	+	+	+	(+)	=	*benhami*
–	–	+	+	–	–	–	–	=	*caementerii**
–	–	+	+	+	–	–	–	=	*madidus*
–	–	–	+	–	–	–	–	=	*pondoanus*
–	–	–	+	+	–	–	–	=	*pentheri, rivus, ritae, montanus*
–	–	–	+	+	+	–	–	=	*decipiens, vernoni**
–	–	–	+	+	+	+	–	=	*microchaetus, papillatus*, rosai*
–	–	–	+	+	+	+	+	=	*braunsi, klopperi, peringueyi, stuckenbergi*
–	–	–	–	+	–	–	–	=	*zaloumisi**
–	–	–	–	+	+	–	–	=	*natalensis*, parvus**
–	–	–	–	+	+	+	–	=	*franciscus, guntheri, ljungstroemi, pearsonianus*
–	–	–	–	+	+	+	+	=	*crousi*

TABLE 2

Microchaetus species arranged in groups according to the number of intersegmental furrows (NIF) with spermathecal pores (species are from the Cape Province unless marked with an asterisk as being from Natal).

NIF	Intersegmental furrows									Species
	9/10	10/11	11/12	12/13	13/14	14/15	15/16	16/17		
0	–	–	–	–	–	–	–	–	=	*namaensis*
1	–	–	–	+	–	–	–	–	=	*pondoanus*
	–	–	–	–	+	–	–	–	=	*zaloumisi**
2	–	–	+	+	–	–	–	–	=	*caementerii**
	–	–	–	+	+	–	–	–	=	*pentheri, rivus, ritae, montanus*
	–	–	–	–	+	+	–	–	=	*natalensis*, parvus**
3	–	–	+	+	+	–	–	–	=	*madidus*
	–	–	–	+	+	+	–	–	=	*decipiens, vernoni**
	–	–	–	–	+	+	+	–	=	*franciscus, guntheri, ljungstroemi, pearsonianus*
4	–	–	–	+	+	+	+	–	=	*microchaetus, papillatus*, rosai*
	–	–	–	–	+	+	+	+	=	*crousi*
5	–	–	–	+	+	+	+	+	=	*braunsi, klopperi, peringueyi, stuckenbergi*
6(7)	(+)	+	+	+	+	+	+	–	=	*mkuzi**
	–	+	+	+	+	+	+	(+)	=	*benhami*

M. madidus is the only species known with the spermathecal pores in 11/12, 12/13, 13/14. Species *rivus*, *ritae* and *montanus*, with spermathecal pores in two intersegmental furrows 12/13, 13/14, belong to group C, along with *pentheri*.

It is worth noting that in 24 of the 27 known species of *Microchaetus* (*ca.* 89 %) the spermathecal pores occur in 13/14 intersegmental furrow (only *caementerii* and *pondoanus* have spermathecae anterior to segment 13, and in *namaensis* spermathecae were not recorded). Occurrence of spermathecal pores in 13/14 is, therefore, highly typical of *Microchaetus* (characterised by the holandric condition), as distinct from *Proandricus* (with proandric characters), in which spermathecal pores occur in 12/13 intersegmental furrows in *ca.* 92 % of known species (the exceptions are: *P. lesothoensis* and *P. pajori*).

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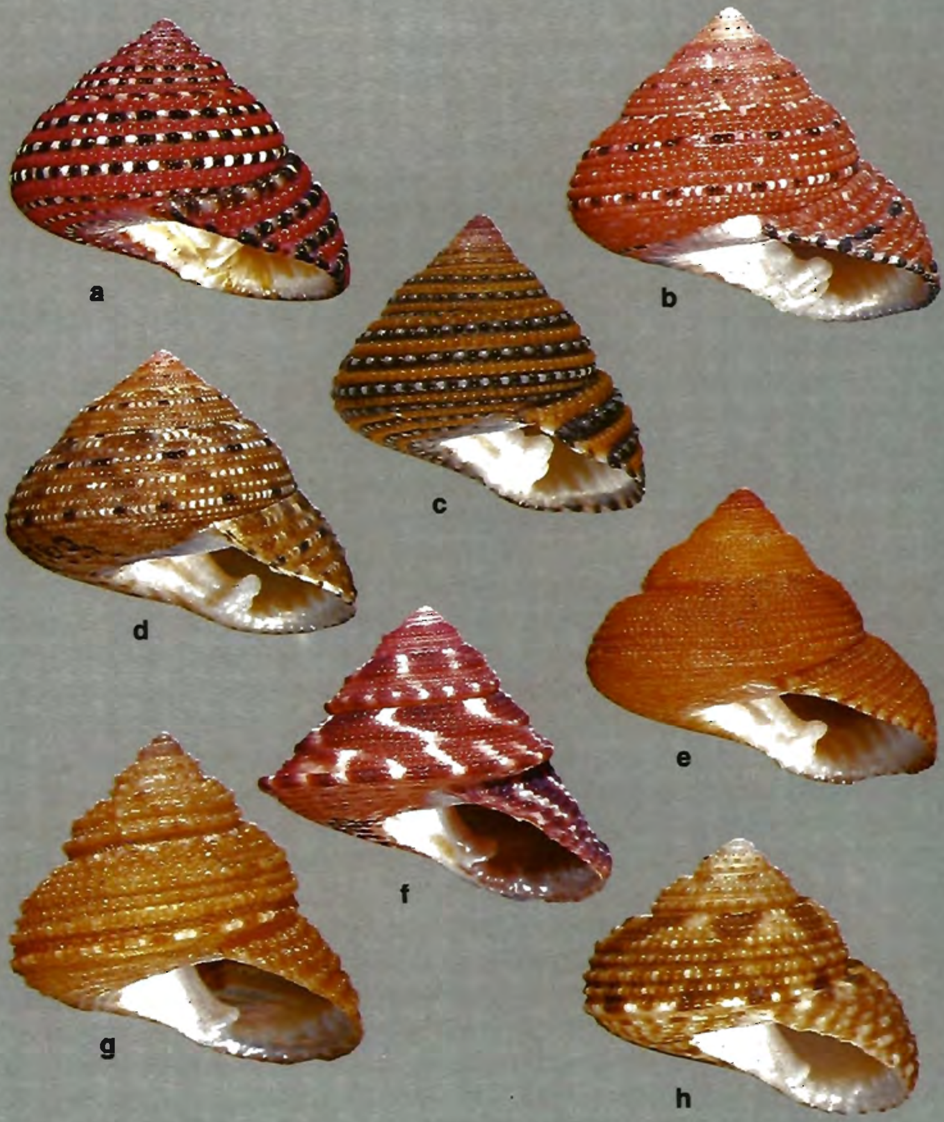

Plate 1. *Clanculus*, type species and southern African species; **a**, *C. pharaonius* (Linnaeus, 1758), Red Sea, diameter 17,0 mm; **b**, *C. puniceus* (Philippi, 1846), Durban, diameter 22,0 mm; **c**, *C. flosculus* (Fischer, 1878), Zululand, diameter 10,5 mm; **d**, *C. atricatena* Tomlin, 1921, Transkei, diameter 18,0 mm; **e**, *C. natalensis* sp. n., holotype, diameter 12,0 mm; **f**, *C. miniatus* (Anton, 1838), neotype, diameter 17,3 mm; **g**, *C. waltonae* Sowerby, 1892, Transkei, diameter 10,7 mm; **h**, *C. mixtus* Smith, 1903, southern Natal, diameter 11,6 mm.